

STANDARD OPERATING PROCEDURE FOR JOHANSON **INDICIZERS®**

Objective

To describe the steps required to set-up, operate and clean the Flow Rate Indicizer, Hang-Up Indicizer and the Hopper Indicizer.

Reference

For technical details and information regarding maintenance and troubleshooting, refer to the manufacturer's user's manual. In addition to the manuals, several papers have been published by Johanson Innovations on the topic of flow indices and powder characteristics. These papers can be found at www.indicizer.com.

Safety Precautions

Use personal protective equipment as deemed necessary for a particular granulation/powder by MSDS and or Safety/Industrial Hygiene. The Indicizers may be placed in a walk-in hood or tall lab-scale hood (with bench space of five feet in length and three feet in height) for testing certain powders or granulations. Operation of the Indicizers can expose the environment and user to airborne particulates.

General Set-Up

1. Check the Indicizers for cleanliness before operating. Re-clean if necessary using the cleaning option in the Upper menu of the display.
2. Calibrate each Indicizer by running the tests described in this procedure with the Gypsum and mineral oil mixture provided as reference material. Compare results to existing data given in the Johanson Innovations Manuals for each Indicizer. This will confirm that the user technique is correct.
3. The reference material should be stored in a resealable airtight container in order to maintain its consistency. Material may be used for approximately 180 days after opening package. After 180 days dispose of properly of any remaining material. Contact supervisor or Johanson Innovations (805-783-7390) to order additional material.
4. Ensure test bench is equipped with outlets and supplied air or nitrogen. A gauge reading of 25 psi is adequate for operation of the Flow Rate Indicizer.
5. NOTE: The Indicizers do not have the capacity to save information from a test run. All values should be recorded for future reference.

OPERATION OF THE FLOW RATE INDICIZER

1. Connect tubing behind the Flow Rate Indicizer to an air or nitrogen inlet. The Indicizer uses a typical dry lab air @ 25 to 100 psi.
2. Power on Indicizer. The Indicizer will run through an initial sequence and then display the lower or test menu. Press escape (the lower left unmarked key on the keypad) to view the upper menu options.
3. The upper menu consists of the following functions:
 - Run a Test**- Returns the user to the lower test menu. (Press 1)
 - Reset the System**- This will put the Indicizer through the starting process, resetting the top and bottom pistons (without the shroud reset). (Press 2)
 - Cleaning**- Initiates cleaning positioning of top and bottom pistons and shroud retraction. (Press 3)
 - Shut down**- May be used to shut off the unit but is not necessary to do so. (Press 4)
 - Setting Units**- Measurement units may be changed in this option from the default U.S. standard to metric. (Press 5)
4. Pressing 1 in the upper menu or ESC in any mode will show the lower menu. This menu consists of the following functions:
 - Flow Rate Index (FRI)**- Calculates all four indices indicative of powder flow properties.
 - Scientific Test**- Allows the user to specify a compaction pressure when determining the Flow Rate Index
5. The test cell consists of a screen disc at the bottom composed of three parts - screen, disc and ring. Make sure the disc is clean and free of any previously tested material. Also, be sure the disc is seated level at the bottom of the cell. Failure to do so will skew test results. The disc does slide out for cleaning purposes. Brush screen or gently blow air through the screen in order to clear openings.
6. Weigh the empty cell with disc and record this value or tare.
7. Fluff the material with a wire whisk to break large clumps and bring material to a state of minimum bulk density. Using a spoon, load the material into the cell and distribute it evenly across the test cell. Do not touch the spoon to any material inside the cell. Be consistent in spoonful size from test to test. Do not pour material into the cell or shake the test cell because this may segregate sample particles or compact the material. Load material lightly and avoid pressing powder materials. This can compress or compact the sample prematurely.
8. Fill material just above the top of the cell. Holding a spatula at a 90-degree angle to the top of the cell, skim off excess sample. Make sure this excess material is not added to the material in the cell. Also, do not let the action of the blade consolidate the material in the cell.
9. Weigh the loaded test cell and make note of the actual sample weight for later input into the Indicizer.

10. Position the cell delicately in the base of the Indicizer and be sure the cell is seated as far to the rear as possible. Failure to do so may result in poor alignment and damage to the shroud. The level of the material inside the cell should drop as little as possible.
11. Proceed to the lower test menu by selecting the desired test, Flow Rate or Scientific.
12. In the Flow Rate index mode, the display screen will ask the user to load cell with material to be tested. Press enter and then input the sample weight obtained previously.
13. Enter the outlet diameter of the hopper or bin to be used. Default parameters will appear on the screen. (Default values: 10-foot bin diameter, 12-inch outlet diameter).
14. Enter the angle of the hopper to be used. Again, a default angle will appear if enter is pressed. The default value is 20 degrees.
15. Plug the small and large hoses on the side of the unit into the cell connections.
16. Once enter is pressed, the test will begin to run and the elapsed time will be shown on the display as the test progresses.
17. Within a few minutes, the results of four tests will appear on the display monitor. Press the enter key to scroll through all four Indices measurements: FRI, FDI, BDI, SBI. Press enter to cycle through results again.
18. Disconnect hoses from cell. Lightly tap the shroud to allow debris trapped in the holes of the piston to fall into the cell. Remove cell and empty.
19. To return to the previous menu, press escape. Press escape to reach the upper or lower menu choices. To run these tests on another sample, repeat steps 5-18. The instrument may be cleaned between materials testing.
20. To conduct a scientific Flow Rate test simply press 2 in the lower menu. All operational steps remain the same as the Flow Rate test with the exception of the prompt for the user to specify a compaction pressure.

Cleaning

Compressed air should not be used in cleaning of this instrument. This could force debris into the electronic areas of the Indicizer. Brush away excess material for disposal. Vacuuming can also be effective.

1. Select Option 3 in the upper menu. The piston will move to its cleaning position. Manually turn the shroud to its upward position until the piston is exposed.
2. Gently brush or vacuum the accumulated solids. Do not apply lateral pressure to the piston as this may cause damage to the load cells or the other precision components.
3. Manually turn the shroud to its downward position (clockwise) after cleaning is complete. Press any key to reset the Indicizer.

4. Wipe off the upper hood, deck and base of the instrument with a cloth or sponge dampened with water or a mild soap solution.

OPERATION OF THE HANG-UP INDICIZER

1. Power on the Indicizer. Verify that the equipment is clean. Clean the equipment if necessary by selecting 3 in the upper menu.
2. The instrument display will show Ratholing or Arching index choices. Press escape to reach the upper menu.
3. The upper menu display appears (see Flow Rate instructions).
4. Press 1 in the upper menu of ESC in any mode to bring up the lower menu. This menu consists of the following functions:
 - Arching Index**- Standard Arching Index. (Press 1)
 - Arching with Time**- Standard Arching Index for over time. (Press 2)
 - Ratholing Index**- Standard Ratholing Index.(Press 3)
 - Ratholing with Time**- Standard Ratholing Index over time. (Press 4)
 - Scientific Mode**- Provides either indexes but the user defines the compaction pressure. (Press 5)
 - Scientific Mode with Time** - Provides either indexes but the user defines the compaction pressure and the time. (Press 6)

Test Procedures for the Hang-up Indicizer

This Indicizer test cell consists of a stainless steel chamber that has a sliding stainless steel free piston. Make sure that the free pistons two pieces are tightly together by twisting in a clockwise direction. Push the free piston all the way into the cell. Prepare material in the same manner as for the Flow Rate Indicizer for each test. Again do not compress or pack the material when loading the cell. Fill to specified weight. You can poke and move the material gently to level the material in the cell.

Arching Index Test

1. Enter 1 to select arching index test.
2. Enter a bin diameter. The default setting is 10 feet.
3. Load cell with sample the same as described for the Flow Rate Indicizer.
4. Enter the weight of the sample and press enter.
5. The user will be prompted as to whether more or less sample needs to be used to achieve ideal weight. If the weight needs to be adjusted, empty the cell and fill with fresh material. Do not fill material above level of rim.
6. Place the cell back in the instrument making sure to fit the cell back into the grooves of the base. Enter the weight of the sample. Then Press enter to begin measurement once an acceptable sample weight has been attained.

7. Place the cell back in the instrument making sure to fit the cell back into the grooves of the base and be sure the cell is seated as far to the rear as possible.
8. If you have put too much or too little material in the cell the Indicizer will tell you what the ideal weight of the material should be. Refill the cell with this amount of material and rerun the test starting at step 2.
9. After measuring compression forces, the display will indicate that the test has been completed and will show the Arching index.

Arching with Time Test

1. Press 2 in the lower menu to begin the arching with time test. The extra prompts in this test include entering the desired length of time for consolidation of material and choosing ideal weight before loading the cell. Follow the prompts as described in steps 2-7 of Arching Index test.

Rathole Index Test

1. Press 3 in the lower menu to begin the Rathole Index test. Follow the same prompts described in steps 2-7 of Arching Index test.

Rathole Index with Time Test

1. Press 4 in the lower menu to begin the Rathole Index with time test. Follow the same prompts described for the arching with time test.

Scientific Test

1. Press 5 to select the scientific test in the lower menu. In scientific mode, the user must define a compaction pressure. All other steps remain the same as when running Arching and Ratholing Indices.

Scientific with Time Test

1. Press 6 to begin the scientific with time test in the lower menu. Enter desired length of time for consolidation in addition to the compaction pressure.
2. The user will then be prompted to enter an internal friction angle. As with the Rathole with time test, select 1 if ideal weight is to be used or zero if it is not to be used. All other steps remain the same as when examining the Arching and Ratholing Indices.

Cleaning

Compressed air should not be used in cleaning of this instrument because this could force debris into the electronic areas of the Indicizer.

1. When option 3 is pressed in the upper menu, the piston shroud, piston and bottom ram will move to the cleaning position to expose the piston. Gently brush or vacuum the accumulated powder or solids.
2. Do not apply lateral pressure to the upper piston when it is in its exposed position. This may damage the load cell. Hit any key of the display when finished.
3. Wipe off the upper hood, deck and base of the instrument with a cloth or sponge dampened with water or mild soap solution.

OPERATION OF HOPPER INDICIZER

Hopper Index

1. The Hopper Index gives the recommended mass-flow angles for various hopper configurations. The Hopper Index is represented in degrees from the vertical plane. Verify that the equipment is clean.
2. Power on the Indicizer. It will reset itself and display an initializing message.
3. A metal cell with a tab will be filled with powder for the Hopper Index test.
4. With the friction plate in the plate holder, slide the plate holder on top of the test platform.
5. Lock down the conditioned plate (condition by rubbing material on the friction plate or run a test and discard the initial results) with the platform lever thumbscrews. Enter 1 to use the Hopper test.
6. Fill the cell with material with the tab facing left. Position the cell toward the right side of the plate holder. Fill the cell completely, trying not to spill over the edge. Place the material uniformly into the cell without pouring. Level the material in the cell, but avoid piling material around the cell. Then press any key.
7. Hang the yoke so that the yoke is centered above the cell. Slide the cell and yoke to the left until the cell rests against the cell stops and the tab on the cell is inserted in the slot behind the cell stops. Lift the cell slightly so that the cell is not in contact with the same plate. Press any key. The Indicizer will not continue if the tab is not inserted correctly.
8. The display will prompt the user to enter the estimated bulk density of the material, or FDI value from the Flow Rate Indicizer. The bulk density of uncompacted material may be used if the FDI is not available.
9. This is a three-part test and the screen will indicate that Part 1 is underway. As the test platform rises, the material will begin to slide. After the Indicizer detects a slide, the test platform will lower. The user will be prompted to proceed with Part 2.
10. Place weight #1 on the yoke and press a key.

11. Slide the yoke and cell to the left until the cell rests against the cell stops and the cell tab is inserted in the slot. Lift the cell slightly so that it is not in contact with the friction plate. Press any key.
12. The screen will now indicate that Part 2 is in progress. Once again, the test platform will rise until a slide is detected. The platform will then lower.
13. Place weight #2 on the yoke and press a key.
14. Slide the yoke and cell to the left until the cell rests against the cell stops and the cell tab is inserted in the slot. Lift the cell slightly so that it is not in contact with the friction plate. Press any key.
15. The screen will now indicate that Part 3 is in progress. Once again, the test platform will rise until a slide is detected. The platform will then lower and the Hopper Index will be shown. The Hopper index is represented in degrees from the vertical plane.
16. Record this value and press any key to return to the main menu.

Chute Index

1. The Chute Index gives the guidelines for acceptable chute angles. The Chute Index is given in degrees from the horizontal plane.
2. With the plate in the plate holder, slide the plate holder on top of the test platform.
3. Lock down the plate with the platform lever thumbscrews. Enter 2 to start the chute test.
4. Fill the cell with material with the tab facing left. Position the cell against the cell stops. Fill the cell completely, trying not to spill over the edge. Place the material uniformly into the cell without pouring. Level the material in the cell, but avoiding piling material around the cell. Then press any key.
5. The Indicizer will automatically apply a pressure to the solids in the test cell to simulate impact against a chute. The adhesion pressure will be applied for 20 seconds. While the pressure is being applied, gently lift and rotate the cell to relieve contact pressure of the cell on the friction plate. When the pressure is removed the test will be in progress. If the cell is disturbed after the adhesion pressure is removed, results will be lower than normal. The test platform will rise until a slide is detected. Then the test platform will lower and results will be shown. Record this value and press any key to return to the main menu.

Cleaning

1. Dust or vacuum off accumulated solids excess material from the metal cell, sample plate, plate holder, platform and slot. Recondition the sample plate before beginning testing of new material.
2. Wipe off the upper hood, deck and base of the instrument with a cloth or sponge dampened with water or a mild soap solution.